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THE NEW PROSPECTUS.

THE College Prospectus for the year 1924-25, is a document which is worthy of careful perusal by those interested in tropical agriculture. The Prospectus naturally deals mainly with courses of study, that is to say it has reference principally to the educational and training functions of the institution in respect of students attending the College and does not concern itself to any extent with the equally important matters of research and extension work. The principal course of study is that which leads to a Diploma in tropical agriculture, and to obtain this Diploma students are required to pass three examinations which are normally to be taken one at the end of each academic year. The first examination must be taken by all candidates, and it includes Agriculture, Botany and Zoology, Chemistry and Physics, Mathematics and Economic History and Geography. The object of this first year's training is to give a grounding in the sciences underlying the various lines of activity connected with the great domain of tropical agriculture. The subjects indicate that this foundation is intended to be of a liberal character, and it will be observed that recognition is given to two aspects not commonly regarded by the layman as essential. The first of these is Mathematics. The recent progress in biological research, in agricultural experiments and in economic inquiry and control renders it necessary for every serious student of tropical agriculture, whatever his ultimate vocation may be to possess a sound knowledge of mathematical methods and principles particularly in relation to algebraical geometry and statistical method. Agriculture, Agricultural History and Geography, the second noticeable feature are designed to render the student familiar with the material and economic environment under which his future activities will take place. Coming now to the courses of study for the second examination leading to the Diploma it will be found that the Syllabus requires differentiation. Students are required to state which one of three courses they elect to take: Estate Management, intended for students who wish to become tropical planters or agricultural administrators; Agricultural Sciences, intended for students who wish to become specialists in some branch of agricultural and natural science, experiment station workers or teachers; and thirdly Chemical Technology provided for students who wish to become specialists in the manufacture of tropical plant products. In prescribing this differentiation it will be observed that it has much in common with that in operation at the University of Cambridge School of Agriculture with the exception that Chemical Technology is introduced at the Imperial College as a full-status vocational subject, and one which is likely to develop considerably in the future. The essential characteristic of this second year's differentiation is the separation as far is desirable of the management and purely technical points of view. It is not possible nor indeed is it desirable to draw a hard and fast distinction, for the Administrator or Manager needs for success biological and physical information just as a purely technical officer needs to know something of the science and art of administration. The valuable feature of the differentiation is that it encourages the formation of definite points of view, prevents that kind of aimless drift which was so characteristic in many agricultural Colleges ten or fifteen years ago. In the third year the differentiation of the second becomes more specialised. In Estate Management, the different tropical crops are studied from the estate standpoint, attention is given to various economic subjects such as accountancy, agricultural law and marketing as

well as to the manufacture of crop products. In the agricultural sciences the final examination includes the Ecology of crop plants, Genetics and either Mycology or Entomology. In regard to Chemical Technology the final examination comprises such subjects as the manufacture of crop products, special Chemical Technology, Factory Control, Analytical Chemistry, Marketing and Mycology. Perusal of the Syllabus will show in general that marked emphasis is laid on Estate Management as a subject in itself, on the Ecology of crop plants, on Genetics and Sugar Technology with which may be included the study and control of technical fermentation processes, rum distillery, cacao curing, coagulation, milk and its products, pen manure and silage. It is difficult in the space available to give any satisfactory account of the detailed instruction or to make it evident how the large variety of subjects ranging from the most abstruse problems of colloid science down to the more everyday but equally important problem of handling the labour supply are fitted in to a continuous system of training. The only explanation lies in the point of view, and anyone who is familiar with the vast variety of problems that occur in tropical agriculture will realise how necessary this point of view is on the part both of the students and the staff. It has been truthfully said that all sciences meet in agriculture, and the new prospectus of the College confirms this by showing that it is necessary to embrace to some extent almost every subject that is studied in connection with science, business and administration. Without point of view this large collection of subjects becomes nothing short of bewildering, and there is no doubt that successful agricultural education depends upon everyone concerned being broadly familiar with general principles of human knowledge relating to agriculture and with the nature of the work of others. A feature of the Syllabus is the provision of special work for fourth year and post-graduate students. Problems for investigations in Agriculture are provided and special topics selected in relation to the problems assigned. In Genetics, lectures practical work and research, problems in genetics and plant improvement are arranged. A special series of lectures on the genetics of cotton is already in operation and similar courses for other tropical crops will later be arranged. In Plant Physiology special work can be provided. Detailed mycological and entomological investigations in regard to tropical crop can be carried out under the direction of the Professors concerned while in Chemistry facilities for the study of problems of bio-chemistry, soil science and agricultural chemical analysis are provided. The erection of the model sugar factory now in progress in the College grounds will soon allow of a continuation of the study of sugar technology for students who wish to qualify for higher posts in sugar factories. With the completion of the new College building space will be available in the present building for chemical technological work with rubber, cotton, fibres and cacao. For students who wish to engage in agricultural administration or in the purely business side of tropical agriculture courses of study can be arranged in regard to the analysis of estate and factory accounts, the methods of Government administration in relation to tropical agriculture and efficiency studies of labour and of general management. From what has been said it will be conceded that the new Prospectus is of a comprehensive character which by means of the scientific grouping of a vast number of subjects according to vocational point of view is likely to serve in course of time a useful function in connection with tropical plant industry and development.

THE YIELD OF BUDDED CACAO.

PROFESSOR S. C. HARLAND, D.SC. (LOND.), F.L.S.

For the last thirty years or more it has been known that the cacao tree is capable of being reproduced vegetatively by means of budding or grafting, though up to the present the area of budded cacao under cultivation remains infinitesimal. The part played by vegetative propagation in the distribution of desirable types of fruit tree is perhaps shown to greatest advantage in temperate climates where apples, pears, cherries, &c., are always grown as "clonal"* varieties under separate and distinct names. Even in the tropics, however, vegetative propagation of good types of mango, avocado, citrus fruits, &c., is carried out to an enormous extent, and probably if cacao had been directly edible a considerable number of clonal types would have arisen, for few plants show more diversity in character of fruit and seed than cacao.

It should be borne in mind that direct breeding for yield plays little part in orchard fruits of the temperate zone, probably because wherever a desirable type of apple arose from a chance seed—say the Ribston Pippin, it was propagated vegetatively without undue regard for its bearing qualities. Thus some varieties of apples and pears are notoriously "shy bearers."

In cacao the main problem before us is to produce fields of uniformly high productivity, while maintaining or improving quality, and so far, in various parts of the world, two lines of approach have been opened up, which consist in propagating from high bearing trees (*a*) by budding or grafting (*b*) by seeds. It is the object of this paper to discuss the significance of some results from budded and grafted cacao obtained by the Trinidad Department of Agriculture at River Estate.

The Experiments: Yield of the Parent Trees.—Since 1910, the yearly return of pods from a large number of trees has been recorded individually at River Estate and it was quickly noticed that certain trees were good-bearing—producing a hundred or more pods annually while others were

*A "clone" is a family of vegetatively-produced progeny the scions of which are derived from a single parent.

just as consistently poor in yield. It was felt that seedlings from superior trees were likely to give better progeny than seedlings from unselected trees, and it has been the practice of the Department for some years to offer for sale seedlings only from superior trees. It was considered likely also that budding from superior trees offered a means of producing uniformly high yielding areas, and many budded cacao trees have been distributed. Experiments were carried out in 1914 in which 28 superior trees were propagated both vegetatively and by seeds as indicated in the following table :—

No. of Plot.	*Mode of Propagation.*	*Total in trees.*	*No. of trees for each parent.*	*No. of parents.*
A	Budded at stake, no shade	280	10	28
B	Budded in nursery with shade	280	10	28
C	Seedlings with shade grafted	280	10	28
D	With shade	280	10	28
E	Budded at stake, no shade	280	10	28

Each of the five plots is laid out similarly, the progeny of each parent (10 trees) either vegetative or seminal occupying a similar position in each plot. There are thus 40 budded and grafted trees in 4 plots, and 20 seedlings in 2 plots, from each of the selected parents. Fruiting began in 1917-18 in both budded and seedling trees and the number of pods produced by each of the 1,900 trees has been recorded for 6 years. Within the compass of this short preliminary paper it is impossible to set forth the full results.*

The following are the chief points of importance :

(1) The total number of pods borne by the different sets of 40 trees from 1917 -23 varies from 261 (set 1229) to 2278 (1114).

(2) Tree 1229 which gave rise to the bad set of budded offspring, has yielded 2,307 pods since 1910 being 5th on the list of heavy bearers, while tree, 1114 which has yielded only 1,380 pods since 1910, is 21st on the list of heavy bearers, but is decidedly the best mother tree of the 28.

(3) There is no correlation between the yield of the parent and the mean yield of its budded offspring, *i.e.*, between a mean yield of 79 pods per annum and 220 pods per annum there is no tendency for the higher yielding trees to produce higher yielding progeny. This leads to the further conclusion :—The yield of a tree affords no criterion whatever of the sort of budded offspring it will produce and the value of a tree for budding purposes must be assessed in terms of the mean yield of its budded offspring.

(4) Certain trees are demonstrably good mother plants and are able to transmit yield to their vegetative offspring. Thus Nos. 1114, 1139, 1454, and 2359 may be picked out as worthy of propagation, while Nos. 1229, 2453, 1285, 407, 2314 and others whose clones have produced less than 1,000 pods per 40 trees in the 6 years are so bad that it would be unwise to propagate from them.

(5) Some slight variation in the order of merit of the clones may result from further records of yield during the next 10 years but this will probably not affect the recommendations in paragraph 4.

Significance of the Results.—The comment may be made that variability of soil and growth conditions is so large in the plots as to render invalid for the purpose of analysis any data on the yield of the various clones. Examination of the yield of the extremely bad clone 1229 in relation to the yield of the adjacent clones, however, shows that its low yield is not due to environment but is inherent. This is shown by the following method of analysis. A block of 9 clones is taken with the 10 trees of 1229 in the middle. The mean yield of the clones is taken and the yield of each clone is taken as a percentage of that mean yield. The following results are then obtained :—

Parent.	*1114*	*1278*	*1386*
	175	69	72
Yield as % of	204	136	34
mean	208	127	127
	195	37	99
Parent.	*1007*	*1229*	*1333*
	64	28	72
Yield as % of	78	10	70
mean	85	24	60
	160	21	66
Parent.	*969*	*1158*	*1304*
	155	101	161
Yield as % of	140	54	174
mean	43	96	132
	135	110	77

It will be seen that the yield of 1229 varies from 10 to 28 per cent. of the mean of the block of 9 in which it occupies the middle, whereas the yield of 1114—the highest clone varies from 175 to 208 per cent. of the same mean. It could be shown statistically that 1229 is significantly lower than any of its neighbours in all of the 4 plots, but such an analysis would not be more convincing than that already made. Taking clone 1114 as the middle of another block of 9 we obtain the following results :—

The yield of the 4 groups of plants of clone of 1114 vary from 178-215 per cent. of the mean yield of the block of 9 of which they occupy the middle position, while the yield of clone 1229 similarly varies from 10 to 23 per cent.

* The full statistical data are available for reference at the Imperial College of Tropical Agriculture, and they will probably be incorporated later in a special memoir. The present writer is indebted to the Trinidad Department of Agriculture for permission to use the results of their experiments for interpretation.

The point may then be regarded as proved—that certain trees, high-bearing in themselves, produce budded offspring of low yielding capacity which is inherent and not due to environmental conditions.

Discussion.—In undertaking an enquiry whether the yield of cacao will maintain itself in vegetative progeny from a high-bearing tree, it is necessary first to get some idea of how the yield of a cacao tree is built up. Fruits come from flowers, and flowers come from buds, so that if the number of buds on a tree were very small, the number of fruits could not exceed this number and the yield would be low. In actual fact, however, the yield of a cacao tree is never limited by the number of flowers produced: often indeed trees bear enormous number of flowers which fail to develop into fruits, but drop off one or two days after opening. The number of flowers, therefore has very little to do with the actual crop produced by the tree, which is built up in the following stages. A certain number of flowers is produced by the tree, of which the vast majority, about 90 per cent. or more, fail to get pollen and drop off the tree unfertilised. Of those which get fertilised only a few per cent. actually form pods, and of those which succeed in setting pods only a certain number reach the mature stage. Some are attacked by pod rot, (Phytophthora), while others dry up when partially mature for reasons which have not yet been worked out but are presumably connected with soil and weather conditions.

It is clear that the yield of a tree is the end point of a long and complicated series of reactions between the constitution of the tree, *i.e.*, its hereditary make-up, and the environmental conditions in which it is placed. The critical stage in the building up of yield seems to be that of fertilization, and observations on the setting of fruit on productive and unproductive trees by R. Parga and the writer at this College indicate that while a productive tree can be induced to set a great many young pods by artificially fertilising the flowers, it is impossible to make an unproductive tree set fruit, however great the number of flowers pollinated. The cause of high yield in cacao is thus primarily physiological; a tree is either a "good setter" or a "bad setter." If a tree is constitutionally a bad setter it does not matter what environment it is placed in, or how rich the soil, it will never produce a large crop, while if a tree be a good setter it will produce a bad crop under bad soil or climatic conditions, but is, on the other hand capable of bringing a large number of pods to maturity under good conditions. It is this type of tree which will respond to good cultural and manurial treatment.

Having thus preliminarily discussed the conditions which favour productivity in cacao, it is possible to analyse the possible effect of vegetative reproduction on each of the main stages of yield-building. This can only be done in a general kind of way, and often only from analogy with other plants. When a bud is removed from a high yielding tree and placed on another stock the environmental conditions are absolutely altered. Every stock is planted in a different kind of soil, and probably no two trees are alike in hereditary constitution, since it is an observed fact that in the progeny of a single tree no two trees are alike. For example in the third generation from a selected tree segregation in respect of at least five Mendelian factors has been observed, which means that there are 32 different possible pure types, besides the impure types which may differ in appearance from those which are pure.

Next must be considered the effect on the setting of fruit of putting a bud from a good setter on to another stock. It would be unwise to conclude that the stock will have no influence on the physiology of this process. Indeed it is most likely that the type of stock will prove a most important factor in this connection, and the ultimate yield of a budded tree may be pictured as a result of the interaction of the setting capacity of the stock, and that of the scion.

The writer is inclined to regard the physiological condition of the stock and the type of root system which it produces, as the predominating influence in the setting of fruit, and it is just as possible that a good bearing tree can be produced by taking buds from a bad setter and placing them on good setting stocks as by taking buds from good setters and placing on stocks the setting capacity of which is not known.

Some experiments carried out by the writer on the yield of budded cotton plants are of interest in showing the effect of budding on the shedding of young fruits. Sea Island which is rather liable to shed its young fruits was budded on to a West Indian perennial stock. The tendency to shed was much reduced in the budded plants. When Sea Island was used as stock, and West Indian as scion, no fruits whatever were set, though the plant produced several hundred flowers. Though there is no close analogy between shedding in cotton, and shedding in cacao, it is significant that in one plant at least, change of stock may reduce the yield to zero.

Observations on the yield of budded rubber, and of grafted apples show also that the stock cannot be ignored as a factor in the yield of vegetatively propagated plants.

It has indeed been shown by Sax and Gowen that the same tendency to wide and permanent variation in yield from tree to tree exists in *grafted* apple trees, and further can be explained by a combination of factors the most important of which are soil and type of root stock. They point out that "since root stocks grown from seed are often extremely variable and may often be weak and dwarfed, it is not surprising that clonal varieties grafted on such stock vary greatly in growth and productivity. The presence of many unproductive trees in our orchard may be attributed in part, at least to the effect of weak or incompatible root stock."

The results obtained by bud-grafting rubber in the East are of a similar nature to those obtained with cacao in Trinidad. An investigation was made by Pirching of the whole status of budding rubber and his views may be stated.

(1) "No evidence could be found existing in the Dutch East Indies proving the unqualified success of bud-grafting as a certain means of raising high-yielding trees.

(2) "A marked similarity in yield (as compared with seed-produced trees) of trees of one clone is indicated by the results of tapping bud-grafted trees. Further, some high-yielding mother trees appear always to give high and above average-yielding vegetative offspring. *At the present time there appears to be no connection, however between the yields of mother trees and their vegetative offspring.*"

Further results from budding rubber in Java have recently been published by Heusser. He concludes that there are mother trees whose vegetative offspring are invariably unsatisfactory although they are themselves high-yielding, and states that "the quality of a mother tree for budding purposes can only be determined with security from the tapping results of its buddings." Heusser is of opinion that the vegetative propagation of rubber must be considered as a temporary measure until seed selection becomes sufficiently advanced to provide heavy bearing strains which come true, and possibly the same opinion may come to be held with regard to cacao.

RESEARCH ON TOBACCO.

FACTORS DETERMINING THE QUALITY.—The tobacco plant is unique in that differences in soil and climate may cause considerable changes in the composition of the plant which make it more or less valuable, or even useless for smoking purposes. So far it has been impossible to determine the exact nature of the soil and climate factors that are responsible for such great differences as exist, for example, between Cuban tobacco, grown in Cuba and the same variety grown elsewhere. That such differences do exist is indicated however by chemical analysis. When a study is made of the relation between soil type and tobacco quality in the principal tobacco growing regions of the world, it is found that certain broad generalizations can be drawn. Thus in the United States of America, the best wrapper-leaf tobacco grows on the dry sandy soils of Connecticut and Florida; the best binder-leaf tobacco, on the light clay loams of Wisconsin; and the best filler-leaf tobacco on the highly fertile loams of Pennsylvania.

The outstanding feature of the tobacco plant is its high mineral or ash content, which varies from 15 to 35 per cent. being about double that of the common crop plants. Extensive investigations in the United States have demonstrated that marked changes in the ash composition of tobacco are brought about by varied fertilizer treatment. Thus in general, heavy liming lessens the amount of potassium and phosphorus in the ash; the use of potassium sulphate improves the burning qualities, but the use of potassium chloride impairs this quality. Aroma is frequently improved by the use of acid phosphate. These results however, are not invariably obtained, because the original quality of the soil also exercises its effects on the final result. Recently, Messrs. V. Graham and R. H. Carr of Purdue University, have definitely stated that changes caused by the fertilizers are of minor importance when compared with changes effected by growing the tobacco plant on different kinds of soils, or under different climatic conditions. (*Journ. Amer. Chem. Soc.*, March, 1924, p. 695.) Furthermore, by extracting different kinds of tobacco with various solvents, they have demonstrated that a good correlation exists between grade of tobacco and quantity and kind of extractible matter. Thus, cigar tobacco was found to contain a low percentage of extractive and nicotine, while pipe tobacco yielded large amounts of soluble matter when treated successively either with petroleum or alcohol. Tobaccos possessing high calcium content, contained nicotine in stable combination with that element, so that they yielded little soluble matter on extraction.

It was found that the aroma of tobacco is not dependent on the nicotine content, and that the sharp, biting quality of certain tobaccos due to the presence of vegetable waxes and ethereal and fatty oils, which, however, can readily be extracted by petroleum. Although the composition of tobacco may be greatly modified by fertilizer treatment, it was noted that the tobacco which commands the best price of any examined was grown on relatively poor sandy or clay soil, and was characterised by a low percentage of extractives, protein and nicotine. It was especially suitable for making cigars of excellent taste and aroma.

F. HARDY.

The production of tea in India during 1922 was 310,000,000 lbs.

The final forecast of the Indian sugar crop for 1923-24 is 3,044,000 tons.

British owned estates produce roughly a quarter of the total output of tea of the Netherland East Indies which is in the neighbourhood of 100 million pounds involving $15 million worth of British capital. It is believed that British tea interests in Java and Sumatra will be vitally affected should preferential duties be levied in Australia which is the third largest tea-consuming country in the world.

It is interesting to note that during the fiscal year ending June 30, 1923, 8,869,699 pounds more of tea were imported into the United States than during the preceding fiscal year and that only 1,002,441 pounds more of tea were exported.

Much attention is being given in Ceylon to the question of the vegetative propagation of tea. This is interesting in connection with the move in this direction in connection with cacao and rubber elsewhere. It is likely to prove valuable as regards the quality of tea.

A TRINIDAD RUBBER ESTATE.

[*In some quarters the impression appears to prevail that Hevea rubber is not grown successfully on a commercial basis in the West Indies. The notes below should be the means of correcting this impression. It may be mentioned that the owner of this rubber, Mr. E. A. Robinson, also possesses and manages* 1,500 *acres of cacao,* 2,000 *acres of coconuts,* 15,000 *acres of sugar-cane and a modern sugar factory capable of producing* 10,000 *tons of* 96° *sugar, as well as an extensive cane-farming organization. The existence of such large and diversified interests under single control in one island is probable unique in the whole industry of tropical agriculture and speaks much not only for Mr. Robinson, but for the versatile nature of Trinidad's soil and climate. The technical financial and agricultural methods employed on these estates are of a standard above the average and on the whole are quite exceptional in the West Indies.*]

Hevea rubber production, on account of the competition of other and older-established industries, of labour conditions, danger of leaf disease and, in places, climatic conditions, has not to any extent developed into an industry in the West Indies. At one or two places however, it has become established in a small way, notably in Trinidad at Non Pareil Estate, Sangre Grande.

The rubber plantations on this estate consists of about 40,000 trees covering some 170 acres. The estate as a whole is mainly planted in cacao, there being 1,500 acres under this latter crop. The rubber plantations which are of pure Hevea, occur in blocks on certain sections where the soil is too poor for cacao. The rainfall is in the neighbourhood of 100 inches per annum, fairly well distributed, except for a rather pronounced dry season between February and May (inclusive). Most of the rubber is on sloping ground and there is natural drainage to a great extent.

The establishment of this rubber (begun in 1912), and its subsequent preparation for market, had all to be learnt by experience and such knowledge as could be derived from literature on the subject. The labour had also to be trained. The training of the tappers and their retention as regular workers (essential in rubber production) was perhaps the most difficult task in this pioneering achievement. No one locally had any knowledge of rubber-tapping as a practical routine part of estate work. Success was eventually achieved, and at the present day Mr. Robinson has efficient tappers some West Indian, some East Indian, many of them women. It is of course, delicate and skilled labour rather than hard labour, and the present workers like it, especially as a task (200 trees) takes only half a day, the remainder of which they can put in on the cacao estate if they wish, dancing cacao, &c. Tappers are paid 40c. a task and the task includes bringing in the rubber to the factory. Before beginning to tap the trees have to be marked for which 30c. per 100 trees is paid.

Trees are tapped on alternate days only. The reason for this is economic, the object being to obtain the maximum amount of rubber per man per day (5-6 lbs. from full-producing trees). All tapping is stopped from mid-February to mid-May, each year. The plantation is cutlassed at the time when the leaves are changing.

The rubber factory employing 8 men and an overseer, consists of the central (main building) of two stories 30 ft. x 25 ft. x 10 ft., containing the smoke store. On three sides of the central building are 10 ft. verandahs, one for mixing, one for rolling and one for packing. There is the usual equipment of smooth roller, rib roller, coagulating dishes, latex cups, collecting pails, drip tins, tapping knives and blades and stores of formalin and acetic acid.

Rubber can be produced on this estate and placed in London at 10½d. per lb. The rubber is good quality smoked sheet. The reasons for the economical production are (*a*) low supervision costs owing to the rubber being part of a large organization ; (*b*) low factory costs ; (*c*) low transport and marketing costs ; (*d*) good-yielding trees (9-year old trees giving 2 lb. dry rubber per tree per annum). The low transport cost is a particularly potent factor. The estate is near a railway station which is only some 30 miles from Port-of-Spain, itself, only 4,000 miles from London compared with Singapore (8,000 miles).

Other factors which are responsible for the success of this estate are (*a*) careful supervision and control of tapping (*b*) systematic routine and (*c*) absolute cleanliness in the factory. The trees suffer slightly at times from leaf disease but so far this disease has not given any serious trouble.

BOOK NOTE.

HANDBOOK OF BRITISH GUIANA.—The last edition of this book was issued in 1913. The edition for 1922 recently issued, has been produced by a Sub-Committee, termed the "Committee of Correspondence and Exhibitions," of the Royal Agricultural and Commercial Society of Georgetown. The geographical position, geological formation, climatic conditions and historical development are succinctly dealt with in short and interesting sketches which also include descriptions of the sugar industry and of the principal towns—Georgetown and New Amsterdam. The political constitution of British Guiana is quite exceptional among the British Dominions. It is based upon the Constitution established by the Dutch. The Colony was twice captured and is our only possession in South America—a very valuable and beautiful one as we may gather from the Handbook. The photographic illustrations take one from pastoral scenes in gardens and cultivated lands to timber felling in the heart of the forest, and the exquisite scenery of the Kaietur Falls which are nearly five times the height of Niagara ; and from up-to-date and well kept Georgetown to the old ruins reminiscent of the days of the Dutch possession. The statistics given in the book are of especial interest notably in regard to immigration (highest in 1874) the decline in gold exports and

therise in the export of rice, diamonds and bauxite. The forests of timber and other resources of the Colony only await the advent of population, capital and management to make British Guiana one of our most valuable possessions. Large and navigable waterways provide access to the mining fields and timber forests of the interior. The Crown Land regulations are fully described. The book is well put together and gives a good insight into the life and workings of the Colony and is full of useful information.

EMPIRE COTTON.

The Annual Report of the Indian Central Cotton Committee for the year ended August, 1923, has been received from the Secretary, Mr. B. C. Burt, B.Sc., M.B.E. It is an exceedingly important and comprehensive report, and it is desirable to place on record in this journal the nature of the Committee, the scope of its activities and some reference to the work in hand. The creation of the Central Cotton Committee was recommended by the Indian Cotton Committee of 1917-18 and was duly constituted by resolution of the Government of India in 1921; while the passing of the Indian Cotton Cess Act and the incorporation of the Committee as a permanent entity with funds and authority of its own took place in 1923. The Committee which comprises representative growers, commercial men as well as scientific officers and officials is now charged with the promotion of all measures which will aid the improvement of the Indian cotton-producing industry; its activities cover the growing, marketing and commercial aspects of cotton and, in addition, scientific research on the plant itself and on the lint (technology). The very large extent of this field of work can only be fully realised by those who know India and the magnitude of its cotton industry. Concerning the work of the year under review, the passing of the Cotton Transport Act to secure reliable evidence of origin has been of first importance since manufacturers buy very largely by territorial description. Again the regulation of gins and presses, another piece of regulatory legislation, will help to reduce the highly detrimental and pernicious practice of mixing. It is also calculated to assist in the securing of more reliable statistics as to yields. The Committee has also taken steps to promote the cleaner picking of cotton and is taking action in the matter of fumigating all cotton imported into India from America and Japan against the Cotton Boll weevil. It is openly stated in the Report that unless the strictest measures are taken it will only be a matter of time before the American pest gains entrance. The Research programme of the Committee is along the lines of genetics and physiology, entomology and technology (spinning tests). There is to be a Central Agricultural Research Institute for Cotton work (probably already established by now) and the services of Mr. and Mrs. Howard have been placed at the Committee's disposal in this regard by the Government. Indore is the particularly well-suited centre for the Institute. Professor A. J. Turner of the Manchester College of Technology has been appointed Director of the Committee's Technological Research, and Research Studentships have been inaugurated in regard to the agricultural aspects. These Studentships are filled from Indian Universities. In concluding this brief notice of the work of a most important organization, we must refer to the valuable information collected by the Secretary in the course of his tours in India and to the able and inspiriting manner in which the report is written.

THE ANTISCORBUTIC PRINCIPLE OF CITRUS JUICES.—That lemon and lime juices possess remarkable curative properties when administered to human subjects suffering from scurvy has long been known. For many years these juices have been included in the dietry of sailors whose access to fresh vegetable food is restricted. The exact identity of the antiscorbutic factor of citrus juices has not yet been established, but it is believed that it is a vitamin or accessory food substance of specifically vital importance. The recent work of S. S. Zilva of the Lister Institute, London, described in the Biochemical Journal (Vol. 17, 1923, p. 410, and Vol. 18, 1924, p. 182) has considerably advanced our knowledge of the chemical nature of the antiscorbutic factor of lemon juice. It was first demonstrated that decitrated lemon juice is just as active as untreated juice. A great part of the solids of decitrated lemon juice consists of invert sugar. It was found possible to remove this sugar by fermenting it with yeast without perceptibly influencing the antiscorbutic activity. The remaining solids seem to consist of substances mainly of a nitrogenous character, but so far the antiscorbutic fraction has not been isolated from them, although a certain amount of information as regards its chemical properties has been accumulated. It has been found for example, that the activity of fermented decitrated juice is largely influenced by the presence of free alkali and of air, which apparently destroy the antiscorbutic principle. In preparing and storing the active fraction, the solution must be maintained at a distinctly acid reaction, and air must rigorously be excluded. Should easy means of isolating the antiscorbutic factor of citrus juices be elaborated at some future date, it might be possible to utilize the waste liquors from the calcium citrate precipitation-vat of the citrus factory for the preparation of this very valuable medicament.

F. HARDY.

A letter has been received from the Hon. E. M. Walcott, Georgetown, Demerara, who attaches great importance to the question of how to cut cane mechanically and carry it to the factory without undue handling. This is a fundamental problem in British Guiana where it is being studied by engineers. The anchorage at the delivery at the canals will probably constitute the main problem.

TROPICAL WORLD.

ECUADOR.

With a desire to extend agricultural exports, the Government have in view the granting of an important contract to a foreign firm to develop the tropical fruit export industry, especially in the Provinces of El Oro and Guayas. In order to handle the large exports anticipated, considerable improvement will be made in the construction of wharves, railways, and the building of an entirely new wharf for ocean vessels at Duran (Eloy Alfaro). Shipments would, however, be maintained from Puerto Bolivar and Puna. In view of the shortage of manual labour, it is intended to offer attractive terms to foreign workmen, to be obtained if possible in the West Indies. It is said that five thousand hands are required at once. From information received from H. B. M. Chargé d'Affaires, Quito, we learn that the position in regard to the cacao crop is still serious. During the first six months of last year the total exports of cacao were 378,012 quintals of 101·47 lbs. compared with 487,570 lbs. for a corresponding period of 1922. The decrease has been due not only to the general economics of the country, but also to "Witch Broom" disease, and further decrease from this cause is to be expected unless it is successfully combated under the direction of the expert from Holland who has been engaged for the purpose of its scientific investigation.

INDIA.

Sir Mahadev B. Chaubal, a prominent member of the Bombay bar and first Indian member of the Bombay Executive Council gave an interesting address a few months ago before the annual gathering at the Poona Agricultural College. After referring to the somewhat remarkable circumstance that the College had had to restrict the number of its students on account of the demand being too great for the Staff and equipment adequately to cope with, Sir Mahadev went on to consider some of the problems of Indian agriculture. While he thought the main object of the College should be to improve the economic productivity of the soil, he felt that the College should exert its influence in respect of that great enemy of Indian Agriculture, the common law of the country which permits sub-division and fragmentation of holdings. A large proportion of the holdings in India are too small to be economically worked, while from his legal experience he knew that disputes and costly litigation were only too frequent. On leaving College, the students should make it a subject of propaganda to point out to cultivators the economic advantages of dividing the produce of a large plot rather than dividing the plot itself. From the Journal of the Poona College it is noticed that a former visitor to the West Indies, Mr. D. L. Sahasrabudhe, who spent some months at the central sugar factories in Antigua and St. Kitts, is one of the Professors there. Moving to Southern India—to Mysore—information to hand indicates that this State has just been through one of the worst agricultural years on record. In the western part there have been floods which have done extensive damage to crop and caused much permanent injury to holdings. Throughout the rest of the State there have been severe droughts which have led to very serious reduction in dry crops and lessened the chance of growing wet crops on tanks. The Department of Agriculture, under the direction of Dr. L. P. Coleman, M.A., Ph.D. has been rendering all assistance possible, including the extensive distribution of seed. The United Planters' Association of Southern India (Incorporated) have recently published in their Journal an appreciative notice of the Imperial College of Tropical Agriculture which will no doubt lead to an extension of the College's interest and usefulness in Southern India.

THE PHILIPPINES.

Dr. C. F. Baker, Dean of the Philippine College of Agriculture, has called attention in a recent article to the different classes of students and the nature of the work of the College. He attaches great importance to that small group of graduates who have gone on into advanced work in America. This, it may be noted, is a different policy to that of the Imperial College of Tropical Agriculture which provides for post-graduates after they have received their general scientific training in England and elsewhere. The largest group of trained men sent out from the Philippine College are those who obtain local employment direct. These at first were absorbed by the Government Bureaus; now that the requirements of these have been satisfied the graduates have turned to active private work and numbers of them are now very successful farmers in many parts of the Islands. A third class of Philippine student consists of those who have taken short courses. These again have taken up business with success, some of them to-day being men of wealth and influence. Dr. Baker adds that although the College of Agriculture is not directly provided with funds for research it is a permanent policy of the College to require every member of its faculty to be intellectually active and a producer of knowledge as well as a teacher.

PALESTINE.

Two principal officers in the Department of Agriculture of this country, which is under British administration, had their preliminary experience in the West Indies. Mr. H. Hedog Jones, M.A., the Assistant Director of Agriculture was for some years in Grenada and Mr. G. Bodkin, M.A., Entomologist, was also for some years in British Guiana. The Director of the Palestine Department, Mr. E. R. Sawer with whom we have recently been in correspondence, states in his review of the agricultural situation, which is a most comprehensive document, that the principal obstacles to agricultural development are drought, the extremely small population and financial stringency and poverty. Palestine is exceedingly poor in all forms of natural resources; even in regard to agriculture only a very small proportion of the

country is cultivable. The establishment of staple crops of high economic value, such as cotton, sugar-cane, &c., depends upon effective irrigation from the tributaries of the Jordan—not a simple matter. Interesting is Mr. Sawer's statement that certain soil types possess a remarkable capacity for retaining moisture. It is difficult to see how even the primitive agriculture of broad-casting and reaping with sickle in practice to-day could be continued without some sort of soil amenity ; for the summers are rainless. On the whole Palestine is sub-tropical. There are frosts in winter but not killing frosts. Fishing is an important industry and the development of it comes within the scope of the Department of Agriculture. There are evidently many natural and social obstacles to be overcome in Palestine before it becomes a land flowing with "milk and honey," but the view point in Mr. Sawer's report is encouraging in respect of future progress.

CEYLON.

The Trade Report for the Chamber of Commerce for last year, shows that there was an increase of over 12 million lbs. in the exports of tea in 1923 as compared with 1922. The total amount of tea exported in 1923 was 183,501,928 lbs.—a figure sufficiently significant to indicate the immense importance of the tea industry of Ceylon. But the good quality maintained for the first three months of the year began to show a decline during April. This is accounted for by the rush of leaf usually associated with that time of the year. The standard for 1923 was generally lower than in 1922, due to the climatic conditions in nearly all districts being unfavourable owing to an abnormal excess of wet weather resulting in the production of teas with more stalk. There were also instances, it is stated, of coarse plucking and lack of care in manufacture, and in view of past experience the importance of maintaining the high standard of manufacture cannot be too strongly emphasized. In contrast to the exports of tea, those of the products of the coconut palm showed a great decrease in 1923, compared with 1922. Leaving out fibre and coir yarn, and taking 1,250 nuts as the equivalent of a "candy" of copra, there was a decrease of approximately 36,000 tons. The low exports were due to short crops and the difficulty of transport owing to flooded roads and an outbreak of rinderpest. Concerning vital statistics, the population of Ceylon, estimated on the basis of the census of 1921, was 4,621,147 at the end of 1922, showing an increase of 81,868 as compared with the previous year. If this rate of increase is maintained the population of Ceylon will have doubled itself by the time the next census is taken. It speaks well for the general health and economic conditions of the Colony.

CUBA.

We mentioned in a previous issue that unexpected rains last January caused great damage to some of the tobacco crops especially in Pinar del Rio. It now appears that this was not as great as reported. In fact, although some tobacco was caught by the rains in the fields, much was got into the curing houses in time, and in Havana Province the rain actually benefited the tobacco and cut down the expenses of irrigation. In regard to new fields of industry, a new railway connecting the capital of Camaguey with the City of Santa Cruz del Sur on the South Coast has been placed in operation, thus opening up for the first time a large section of virgin forest lands that will be soon converted into fields of growing canes for the new mills that are planned along the line. It is said that the National City Bank of New York controls most of the territory feeding this railway and that the General Sugar Company will erect mills and convert this rich section of Southern Camaguey into "colonias" as rapidly as the machinery can be placed on the ground. Another development is the North Shore road of Cuba which passes for the greater part of its length through a virgin forest that lies between the sea-coast on the North and the Sierra of Cubitas mountains, and most of this vast territory is said to be excellent sugar-cane lands which sooner or later will be yielding its tribute to the industry which forms the present basis of Cuban prosperity.

HAWAII.

Dr. H. B. Agee has written to Professor Ashby of the Imperial College of Tropical Agriculture in regard to the Pan-Pacific Union which is going to be held in Honolulu, July 31 to August 14, 1924, and which will take the form of a Food Conservation Conference. Steps are being taken by the Union officials to organize a cane sugar section and in doing this the field is being extended beyond the immediate Pacific area in order to include all parts of the cane sugar world. Invitations are being issued to most authoritative workers connected with the cane sugar industry and the Conference should prove to be of exceedingly great interest and importance especially as it is being held in what is perhaps from the technical point of view at any rate the leading sugar cane territory of the world. For the benefit of those unacquainted with the objects of the Pan-Pacific Union it may be stated that it is an organization directed by representatives of all Pacific races, supported in part by Government appropriations co-operating with diverse Chambers and organizations for the advancement of Pacific interest bringing together through frequent conferences at the Ocean's cross roads leaders in all lines of thought and actions in Pacific lands. The tentative agenda for the forthcoming Conference in August include International Law, Fishery, Entomology, Plant Quarantine, Plant Pathology, Crop Production and Improvement, Animal Husbandry, Meteorology, Forestry, and Food Transportation and Distribution. It is not likely that the Conference will be attended by any representative of the Imperial College of Tropical Agriculture on account of the Mycological Conference and the Empire Exhibition in London.

ESTATE ACCOUNTANCY.

PROFESSOR W. R. DUNLOP.

[*The following is the second article on this subject and deals principally with the nature of a Balance Sheet, double-entry and finance. The first article, in last month's issue*, had reference to the general aspects of estate accountancy and the purposes accountancy should serve, especially from the standpoint of administration.*]

Practical Considerations.—In practice an efficient accountancy system demands (*a*) knowledge of principles, methods and aims; (*b*) the keeping of adequate daily records and the abstraction or analysis of same at stated intervals. In approaching the average manager of the medium sized estate, it has been my experience to find that if he possesses no particular knowledge of or taste for accountancy, the ultimate request will be "Draw up some books for me and I will see what I can do." On very large estates the manager will generally permit full inspection of the detailed sheets and ledgers, and while admitting that faults can be found in regard to the system in theory, he will claim that his system "works" and provides all that is necessary for the purposes of the estate and his principals. Since it is the theory and not the keeping of actual records which in my opinion constitutes the weakest point in tropical estate accountancy (that is on estates of considerable size), I shall not deal with routine records first even though they be technically primal to what is aimed at. I propose to deal chiefly with principles, definitions and methods first, thereby leading up to examples and finished accounts. After that we can consider what routine work is needed on the estate to produce these final statements and statistical information, and whether the work involved is worth while and possible from the practical and administrative points of view.

Balance Sheet.—It has been pointed out that accountancy can be separated into three divisions: (*a*) Financial, (*b*) Cost, (*c*) Statistical. The Balance Sheet is the fundamental statement in financial accountancy and shows, at a given date, the financial standing of the estate, *not that of the owner or owners.* Below is the form a Balance Sheet should take for a privately-owned 200-acre coconut estate at December 31, 1923, according to information provided by properly kept books.† This example has been purposely selected on account of its simplicity.

DR. BALANCE SHEET OF A PRIVATELY-OWNED COCONUT ESTATE. CR.

LIABILITIES.		$	ASSETS.	$
Mortgage		10,000	*Fixed.*	
Capital	$ 60,201		Field A	6,565
Less Private Account ..	10,000	50,201	B	6,315
			C	6,545
			D	6,515
			E	6,610
			F	6,471
			G	6,385
			H	6,415
			Buildings	5,400
			Water Supply	500
			Floating.	
			Carts and Implements	180
			Cattle	300
			Sheep	120
			Horse and Buggy	140
			Liquid.	
			Nuts on hand	80
			Manure (kainit)	20
			Bags	75
			Cash at Bank	1,565
		$ 60,201		$ 60,201

The assets, it will be noted, are the total possessions of the business (*i.e.* of the estate), and are divided into three categories: Fixed, Floating and Liquid. The liabilities are what the estate owes; in this case $10,000 to a mortgagee, and $50,201 to the owner. This debt to the owner is the amount he has of his own invested, and is his Capital to date. It is the difference between other liabilities and the total of the assets. Concerning the

* Copies can be obtained from the College, St. Augustine, or from the Secretary, 14, Trinity Square, London, E.C., 4, England.

† The values are expressed in dollars and cents because this currency is more efficient arithmetically than sterling. Dollars and cents will be adhered to throughout these articles. To convert dollars and cents into sterling, roughly, divide by 5 (error,—4·2 per cent. of the result.) $480=£100, or 1 cent=½*d.* (at par.).

liabilities, it will be noticed that the owner, instead of paying off his mortgage, has drawn $10,000 from Cash at Bank for private use, may be to re-invest it at a higher rate of interest than he is paying on his mortgage; more likely to spend it on a trip to Europe or partly to pay for the education there of his children. When assets exceed owner's liabilities the business possesses capital and is said to be ownership it is not, which partly serves to explain why a Balance Sheet is so seldom found in the books of ordinary private estates.

Double-Entry: Finance.—In the management of private estates, double-entry is seldom to be found employed, and generally the mere mention of it suggests something illusive, complicated and

COCONUT ESTATE LEDGER.

CAPITAL ACCOUNT.

Dr. Date.		$	Cr. Date.		$
			1924 Jan. 1	By Balance (Sheet) ..	50,201

BANK ACCOUNT.

1924		$	1924		$
Jan. 1	To Balance (Sheet) ..	1,565	Jan. 15	By W. Account	90
20	Revenue Account ..	800	30	W. Account	110
			30	W. Account	70
			30	P. Account	300

PRIVATE ACCOUNT.

1924		$	1924		$
Jan. 30	To Bank	300			

WORKING ACCOUNT.

1924		$	1924		$
Jan. 1	To Valuation (B.S.) ..	58,636			
15	Bank (for fortnight's wages) ..	90			
30	Bank (for fortnight's wages) ..	110			
30	Bank (for Overseer's and Driver's salaries) ..	70			

REVENUE ACCOUNT.

1924		$	1924		$
			Jan. 20	By Bank (for Coconuts sold) ..	800

MORTGAGE ACCOUNT.

1924		$	1924		$
			Jan. 1	By Balance (Sheet) ..	10,000

solvent. If the owner's liabilities exceed the assets, the business is said to be *insolvent* and the difference is termed *Deficiency*. In starting an estate the first thing to prepare is a "Statement of Affairs"; and in running an estate a Balance Sheet should be drawn up at the end of each financial year if not at more frequent intervals. The Balance Sheet of a Public Company, dealt with at the conclusion of this article, is framed on the same principles and takes a similar form, but the assets are usually classified under much broader (and frequently more ambiguous) headings. In the case of a Public Company it should be remembered that a Balance Sheet is legally compulsory. In private

unnecessary. Even on Company estates the double-entry system appears seldom to be utilised to the best advantage, *i.e.*, in respect of financial cost-accounting. In order to explain the nature and financial uses of double-entry we will continue to consider the 200-acre coconut estate. Double-entry is as most people know, associated with an account book containing a classified collection of transactions, known as a ledger. The object of this book is to show at any time "how you stand" in respect of both profit and loss and liabilities and assets. The simplest possible ledger would for the estate under consideration during the first month of 1924 be somewhat as above.

It will be observed that every item is posted to the debit side if the account receives or owes, and posted to the credit side if the account gives or is owed to. Items from the last Balance Sheet at December 31, 1923 (which is the position of the estate as a whole at January 1, 1924), have been entered exactly according to this principle. It helps to make the method clearer if we regard each account as a person, and if we view the entries from the stand-point of that person. Capital Account is really the investment account of the owner of the estate (in regard to the estate); Private Account his personal account (in regard to the estate in 1924) Mortgage Account is the account of the mortgagee (in respect of the estate's Balance Sheet); Working Account is mainly, but not entirely, the overseer and labourer's account (in respect of the estate). All these accounts can be "balanced" at any moment; but before the Working Account can be balanced a fresh total valuation of working assets must be entered on the credit side to account for depreciation or appreciation. The difference between the balance of the Working Account and that of the Revenue Account is the profit to date. It is important to realise that it is possible to make a profit without producing an increase of cash in hand. In making a new Balance Sheet (in the case of a *private* estate) the Profit and Loss balance together with the Private Account balance are carried to the appropriate sides of the Capital Account, and the balance of this account carried to the Balance Sheet along with all assets and all outstanding liabilities, which must be brought up to date. It should be noted that interest on mortgage passes between Bank Account and Working Account. Such interest is a working expense. Interest on owner's capital is never a working expense. The accounts shown above can be kept by any educated owner or owner-manager without much difficulty. They should be kept posted day by day every time a cheque is paid or received. If there are any credit transactions personal accounts must of course be opened. The object of the above ledger accounts is to show the estate owner how he stands financially at any moment and to afford a permanent classified record. The foregoing accounts are not adequate for an explanation of the working of the estate; they are merely general financial accounts. At the end of the year formal cost-financial ledger accounts and Balance Sheet should be prepared involving analysis of the estate's pay lists, &c., and monthly abstracts. This however will not be considered here. The point to realise here is the idea of double-entry and its value in disclosing the true financial standing of an owner in respect of his estate. As regards the method itself, the points to grasp are that every "receiving account" is debtor to its opposite "giving account," and that incidentally this can happen without any cash directly passing, as when an oxen receives grass from a pasture, or an arable field the depreciation in the using of an implement of tillage or the owner the services of the estate buggy or motor-car for purposes external to the business.

Bank, Cash and Capital.—It is obvious that every estate should have its own bank account, separate from that of the person or persons to whom the estate belongs. As far as possible all payments should be made by cheque in order to simplify book-keeping and to reduce the chances of a mistake. Cheques for wages should be made payable to "Wages" or "Working Account." A cash account or a petty cash account may be necessary if money is kept on the estate. If such is the case, the money should be kept in a separate cash box and a petty cash journal provided. Owner's cash on deposit at the bank, unless derived from estate profits or specifically credited to Capital Account as fresh capital is not an asset of the estate. When fresh capital is brought into the business, the Bank must be debited and either, capital or (in case of a loan), the lender credited who, in the case of a mortgagee is really a temporary sleeping partner, his profit being on a fixed percentage basis (of his capital). A debenture-holder in a Public Company, it may be noted is closely allied to a first mortgagee. Both have first claim on the assets in proportion to their invested capital.

Continuity, Uniformity and Purpose.—It was laid down in the first article that scientific accountancy must have continuity, uniformity and purpose. The methods and ideas at present being outlined conform to this principle. The Balance Sheet is the analysed position at an instant on a continuous curve of plus or minus capital values in time. Fundamentally scientific accountancy method is based on the "Efficient" of Cross-multiplicative Groups and Statistical Science. At the present stage these considerations are merely of philosophical interest.

Peasant's Accounts.—From a strictly logical point of view we should consider next the balance sheet, &c., of a Public Company, but it will be more interesting first to descend to a consideration of accountancy possibilities in respect of the small native planter with ten to twenty acres under cultivation. There are vast legions of such agriculturists in the tropics, and if our claim to the universal application of scientific accountancy is to be justified, it will be necessary to show how the principles can be made to fit in this particular direction. Generally speaking the small native cultivator is not able to think things out for himself and is scarcely able even to read or write. It is obviously necessary therefore to reduce the financial system to a purely mechanical basis as far as possible. The following weekly or monthly account card which I have recently drawn up, to some extent succeeds in doing this.

In considering it we must bear in mind that on the estate of a peasant, domestic economy and industrial economy are exceedingly difficult to separate. In other words it is almost impossible accurately to draw the line between estate transactions and private transactions. To be scientific however, the system must make an attempt in this direction and since the one adopted is a very

compressed mechanical system, cost and financial aspects are necessarily involved at the same time. In examining this specimen card only the "head" of which is given here for reasons of space, it will be observed that the Balance Sheet is very simple and involves only debts and floating and liquid assets, and, of course, only those assets belonging to the estate itself. The expenditure and receipts a new Balance Sheet. Account cards such as that suggested above should *not* be distributed by Government Agricultural Departments since this tends to arouse distrust and suspicion in respect of taxation. The cards should be sold and circulated through ordinary commercial channels, though the local Department of Agriculture may be secretly the instigator.

MONTHLY ACCOUNT CARD FOR A SMALL NATIVE-OWNED ESTATE (COCONUTS CHIEFLY).

1924 — BALANCE SHEET (*Incompleted*).

Jan. 1 — DEBTS.	$
Loans	500

"PROPERTIES" (=ASSETS*).	$ c.
Cash on hand	120 00
1 donkey	20 00
4 pigs	20 00
2 fowls	1 20
2 cutlasses	60
1 cart	40 00

	EXPENDITURE.										RECEIPTS.						
					Daily purchases						Sales of Coconuts.			Other produce sold, *e.g.* Ground provisions.			
	Outside help (Wages paid for work done).	Unpaid labour (Owner and family or friends, days and half days).	Cash Advances.	Livestock bought or died.	For estate.		For household.		Debts on Interest paid.		Quantity.	Value.	Sale of Livestock.	Quantity.	Value.	Loans.	Other receipts.
					Cash.	Credit.	Cash.	Credit.									
Jan. 1	60c.	2															
Jan. 2	30c.	2½				50c.								2 pts. corn.	household.		
Jan. 3								$1			400	$10					
etc.																	

* Land, buildings and other fixed assets are not included in this Balance Sheet.

columns differentiate between cash and credit, paid labour and family labour, day's work and cash, sales and household consumption, and purchases for the estate and purchases for the household. The credit aspect will be seen to be a very prominent feature. This is necessary on account of the important part which credit plays in tropical peasant agriculture. Obviously double-entry is out of the question with owners who will frequently have to rely upon their more educated children to put in even the figures demanded; but the underlying idea of scientific accountancy will be seen to be incorporated as far as possible. At the end of each month or six months the owner, with the help if necessary of his children or a more intelligent neighbour would be expected to "pick out" his financial position from the recorded data and make

Company Balance Sheet.—It has already been mentioned that a Public Company Balance Sheet is to some extent a legal as well as a financial document since its publication is compulsory by Commercial Law. In the case of the one given below, which is the Balance Sheet of a large sugar estate and factory for the year ended June 30, 1923, it will be noted that it differs from our private Balance Sheet of the coconut estate in the following important respects: (*a*) the capital is sub-divided in accordance with the manner of its subscription, (*b*) the profit and loss balance is not included in capital, the reason being that no Public Company may reduce or increase its capital without public notification, (*c*) the asset headings are extremely generalised. Technically this Balance Sheet does not convey very much information beyond the

general financial position of the business. An instructive point in this Balance Sheet from the point of view of the student, is the fact that the liabilities exceed the assets, the deficiency being the balance of the Profit and Loss Account, which account is supposed to show how the deficiency (or loss) has in the past arisen. The Capitalists are for a very large estate, a medium sized estate and an extremely small estate, and in addition have explained the method of double-entry and the distinctions which should be drawn between cash, capital and other conceptions which underly the general financial administration and management of tropical estates.

SUGAR COMPANY BALANCE SHEET.

DR. LIABILITIES.	$ c.	ASSETS.	CR. $ c.
Share Capital			
Authorised. 750,000 shares of $4.80 each.		Cash at Bankers and in hand ..	140,873 86
Issued. 699,585 shares of $4.80 each fully paid ..	3,358,008 00	Cash in hands of Trustees ..	500 00
Ten per cent. First mortgage debentures plus accrued interest on same to date	250,915 06	25,060 Oil Shares of $4.80 each, fully paid	Not valued.
Loans from Bankers on Estate Security	424,800 00	Sundry debtors	38,754 08
Sundry creditors	177,993 88	Stocks (Sugar and Molasses) ..	374,234 32
		Stores and Materials	458,582 58
		Properties account—*Less* Sale of Plant *Less* Mortgage ..	2,826,073 88
		Profit and Loss—As per last Account *Less* profit for year ended June 30, 1923 ..	372,698 22
	$4,211,716 94		$4,211,716 94

debtors to Profit and Loss for this deficiency, and in *private* business the capital should be written down accordingly, thereby reducing the liability of the business in respect of the owner. As regards the information on which the Balance Sheet and its accompanying Profit and Loss Account are drawn up, it may be stated that the requisite information is for the most part supplied from the Estate to the Head Office of the Company under the following heads: (*a*) Estate's Cash Account (fortnightly), (*b*) Estate's Analysis Sheet (field operations—fortnightly), (*c*) Central Office Ledger (Annual Return), (*d*) Factory Ledger which includes cash expenditure, stores used in manufacturing operations, repairs and railway expenses. The fundamental information is of course contained in the Central Office Ledger (Annual Return) and the Factory Ledger (Annual Return) and naturally a double-entry financial system must be employed in respect of this information at the Company's Head Office in order that the Profit and Loss Account and the Balance Sheet may be prepared. In the Profit and Loss Account the main heads of expenditure are Estates, Factory, Administration, Medical, Railways, Taxes and Exchange and Cane Farmers. It is not our purpose at this stage to consider the above Balance Sheet and its underlying system critically. We are concerned at present mainly with description. Later on, however, we shall have occasion to consider to what extent these heads of expenditure and receipts are significant and also the basis of the valuation of the property and the reasons for the acquirement of credit in the form of loans.

Summary.—Summarising, we have, in this article, considered the form of a Balance Sheet

THE ATTRACTING OF ENTERPRISE.

Costa Rica is, for those already established there, like the United Fruit Company or the owners of large coffee fincas, familiar with local conditions, a rich and excellent country, and San José the capital, is one of the most attractive of cities; but V. Torlesse Murray, who is presumably a woman, rather weakens an otherwise interesting article to the January number of "The Contemporary Review," by holding up Costa Rica as a possible field for the unemployed of Europe. Quite apart from the stronger call and claims of the British Empire, it is scarcely likely that the article will be the cause of attracting the unemployed but enterprising capitalist, and the conditions described are certainly not likely to entice people who are sound, practical and appreciative of a reasonable degree of comfort and safety. This is to the good, for much harm has in the past been caused as the British Overseas Settlement Bureau, for instance, could confirm, through misleading—sometimes deliberately—misleading descriptions of undeveloped tropical countries. As is so often found in general literature, the writer eulogises on the potential wealth of the country: "Sugar-cane flourishes like the green bay tree and has a much more rapid yield. . . . Bananas require comparatively little labour, and if planted on the same ground as coffee, serve the double purpose of giving shade to the latter. . . . The greater part of the country consists of virgin forest, untouched timber of the most perfect description for the uses of civilization" are typical statements, for the most part technically untrue. But even if they were representative of

the facts, such matters as labour, communications and transport, marketing facilities, educational facilities and sociological conditions and health, are just as essential for successful settlement as potential resources like the fertility of the soil. In places the article is not devoid of an unconscious humour: "The Country," according to the writer, "is literally teeming with beasts, birds and insects of all kinds . . . the jungles must be full of all kinds of beasts and a great many come out into the open . . . . On the whole, then, life under the shadow of the two big volcanoes of Costa Rica, the one active, the other extinct can be a very pleasant thing." These observations scarcely seem to embody the ideal pronouncements for the attraction of serious enterprise and settlers.

CLIMATE FOR GROWING OLIVES.—The olive will grow but will not produce fruit at ordinary elevations in the tropics. The range of temperature at which the olive can be grown varies from a minimum that does not often sink to 20° F. to a maximum that does not often rise to over 104° F. and the mean temperature of the coldest month should not fall much below 45° F. to get good results. This is a slightly more equable temperature than is required for the vine, as that plant will thrive in a more extended range of temperature than the olive. Some varieties of olives will stand more cold than others, and extra heat does not harm them as much as extremes of cold. They do best at altitudes ranging from 150 to 3,000 feet. At lower altitudes, especially near the seaboard, where misty rains and fogs prevail and the weather is somewhat muggy, it is difficult to obtain good quality fruit, as these conditions tend to favour attacks of the fungoid diseases and insect pests to which the olive is subject.

RESEARCH IN ZOOLOGY.

In 1918, the University of Iowa sent a scientific expedition on a visit to the West Indian Islands of Barbados and Antigua. The University Magazine, *Studies in Natural History*, has published papers relating to this expedition, first a general account of its objects and of the results achieved—and later reports on some of the collections made.

The latest number (Vol. X, No. 3) contains five more of these reports, each dealing with the specimens coming within a certain group. The reports are these: Ants by William Morton Wheeler; Certain Families of Hemiptera Heteroptera by H. G. Barber; Aquatic Insects by J. R. de la Torre Bueno; Spiders by Elizabeth B. Bryant; and Polychaetous Annelids by Catherine Agnes Mullen.

The paper on ants adds to our knowledge of the occurrence of well-known and widely distributed species and while no new species are listed several new varieties and sub-species are described. Only one new species of Hemiptera Heteroptera is described, but interesting notes are given on the distribution of several of these insects. For instance *Blissus leucopterus* a comparatively rare insect in these islands where it is native and of wide occurrence, is the insect which is a very serious pest in certain parts of the United States, where it has been introduced. The paper on Spiders includes descriptions of six new species, and that on the Polychaetes in addition to listing the species collected gives an account of these Marine worms as to their affinities, their habits and the conditions under which they live.

H. A. BALLOU.

COLLEGE NEWS.

The Summer term opened on Monday, April 7. Term ends June 28.

Professor Dash and Professor Dunlop proceeded to British Guiana on March 29, and returned to Trinidad a week later after devoting several days to visiting British Guiana sugar estates and rice cultivations and getting into touch with local people having agricultural interests.

Professor Ballou left Trinidad on a visit to Antigua (Leeward Islands) on May 4 in connection with official duties.

Several Diploma students have registered a desire to secure employment on estates or elsewhere during the summer vacation (June to October). This is commendable and the Principal is communicating with estate proprietors and others on the subject. Last year one or two students undertook overseer's work at the Usine Ste. Madeleine, and this year owing to the large number of estate people going to England on leave it should not be difficult for students to find acting positions. Student work on estates during long vacations is quite common in the Colleges of North America and in England, and is frequently of great mutual advantage to both student and employer. Estate managers or proprietors interested in this matter might find it worth while to communicate with the College at once on the subject.

Work has been begun in connection with the erection of the College Sugar Factory. The work is being directed by Mr. G. Mayes, the erecting engineer who has been associated with Mr. C. T. Berthon of London in the preparation of the plans. Mr. Mayes arrived in Trinidad on April 6. The new building will be about 112 ft. long by 56 ft. wide. The machinery for this factory which is of a very complete and up-to-date character has been provided by free gifts on the part of the leading makers of sugar and allied machinery in Great Britain. This factory will constitute a very important addition to the College equipment.

Mr. Overton Boyd, B.A., Louisiana Stabe University and Audubon Park Sugar School, has been appointed Professor of Sugar Technology, and will arrive in Trinidad sometime in June.

Consideration is being given to the early provision of equipment for the study of the chemical technology of copra, rubber, &c.

Rapid progress is being made with the new College building, which should be ready for occupation by October.

TREND OF THE MARKETS.

[*The notes below are based principally upon running charts of the prices of the basic grades and upon general statistical information gleaned from contemporary publications and cablegrams and are intended to be a record of movements. An attempt is made, where possible, to indicate the market outlook at the time of going to press, but no responsibility for the accuracy and subsequent truth of such observations is assumed. Unless otherwise stated the prices quoted are spot, London.*]

SUGAR.—Though there has been a period of quietness, and values in New York since the middle of March to mid-April have declined from 7c. to 6c. there appears to be a strong potential buying power ahead which is likely to be felt as a result of the trade carrying little or no surplus stocks.

COTTON.—Towards April, Middling Upland (Liverpool) rose from 16*d.* to 19*d.* per lb. with a subsequent tendency to decline at April 18. Fine Sea Island 27*d.* per lb.

CACAO.—Trinidad cacao in New York declined slightly during the first half of April but for the present may be regarded as steady around 9¾c. per lb. Since mid-January fluctuations of Trinidad and Accra have been similar. World production exceeded world consumption during 1923.

COFFEE.—Rio No. 7's (the Brazilian basic and lowest price grade) have been jumping into prominence on account of the shortage of higher qualities. Santos next grade to Rio's sold at the high price of 96*s.* per cwt. (London) middle of March At the end of March there was a decline in values.

TEA.—The Indian average was showing a slight tendency to decline during March fluctuating around an average of 17½*d.* per lb. compared with an average of 19½*d.* last October.

SISAL.—Prime sisal has been buoyant reaching £44 10*s.* a ton March 19, having risen steadily to that point from £35 a ton at the end of November last. Following March 19 there was a slight decline, but Manila hemp was firm at £38 15*s.* for J grade.

RUBBER.—The market has been weak and prices have dropped to 1*s.* per lb. (March 26) compared with 1*s.* 4*d.* last September.

RICE.—The high level of last January has been slowly descending to £16 10*s.* per ton at the end of March. The statistical position appears good however from seller's standpoint on account of short crops.

COPRA.—Copra has sharply declined from £33 per ton, end of February to £30 end of March, for prime grades. (F.A.Q. Ceylon.)

VEGETABLE OILS.—Most items in this market have since our last issue shown some decline. Palm oils have moved down considerably; cotton, ground-nut and palm-kernel oils have been dull features. Palm oil: Lagos, 39*s.*, crude palm-kernel 44*s.*, crude ground-nut 53*s.*

CITRUS PRODUCTS.—Raw and concentrated lime juice on March 11 continued firm with no change in values. Lime oils, steady to firm; hand-pressed 6*s.* 6*d.* to 7*s.* 6*d.* per lb.; distilled, 4*s.* 6*d.* per lb. West Indian sweet Orange oil 9*s.* 6*d.* per lb.

SPICES.—Pepper, ginger, cloves and nutmegs have all ruled firm to steady in March. Ginger was dearer pending the arrival of the new crop.

The final estimate for the Indian 1923-24 cotton crop is 5,075,000 bales.

The Indian rice crop is likely to be four per cent. lower than in 1922-23, being estimated at 33,468,000 tons.

A leading coffee planter of Uganda, who has visited Brazil (Sao Paulo) advises that an attempt should be made in Uganda to imitate production methods in Brazil especially in regard to securing maximum yield from individual trees.

It is stated in Vasmar's cacao report that the annual exhibition of the trade held last September in England showed an improvement in the quality of the chocolate displayed and that it would appear that the public taste has grown tired of the low grade chocolate placed on the market a few years ago.

The world's production of cacao in 1923 was 456,000 tons and the consumption 431,300 tons.

The worst prepared cacao now received on the London market comes principally from Haiti and Lagos (Nigeria).

The estimated production of vanilla beans in Madagascar, including the Comoro Islands and Reunion and Mauritius for 1923-24 is placed at 848,220 lbs. compared with 675,710 lbs. for the previous season. In Seychelles Islands the output in 1922 was not more than 1,000 kilos and in 1923 the production was less. The price of vanilla has recently been firm on the London market.

In connection with the recent decline in the price of copra, it may be noted that Lord Leverhulme who, after visiting Colombo, Madras, and other vegetable oil marts arrived in Calcutta on February 26, last, has expressed the view that there is not the slightest possibility of coconut oil being superseded by any other oil, and has stated that he has seen nothing in any development in any part of the world which can shake the present position occupied by coconuts.

The labour strike situation in Cuba assumed a more than usually critical aspect at the beginning of April, mainly in connection with the railway men.

Investigations made by United States Bureau of Entomology and Bureau of Agricultural Economics have shown that the average annual loss to the Louisiana sugar-cane crop by moth-borer is approximately 19 per cent. In 1922 the damage was 17 per cent. of the crop; in 1923 it amounted to as much as 23 per cent. of the crop.